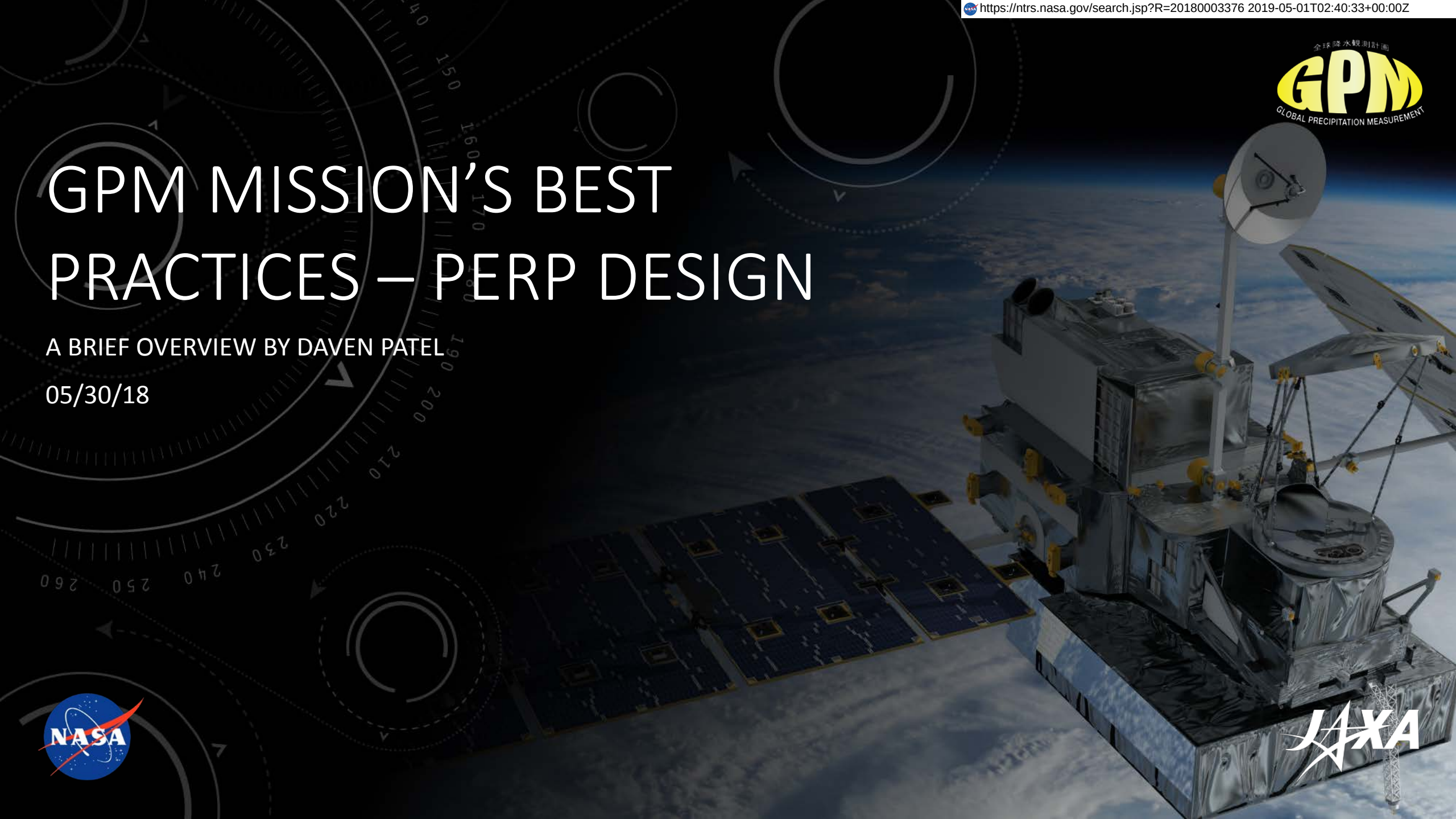
https://ntrs.nasa.gov/search.jsp?R=20180003376 2019-05-01T02:40:33+00:00Z

# GPM MISSION'S BEST PRACTICES – PERP DESIGN

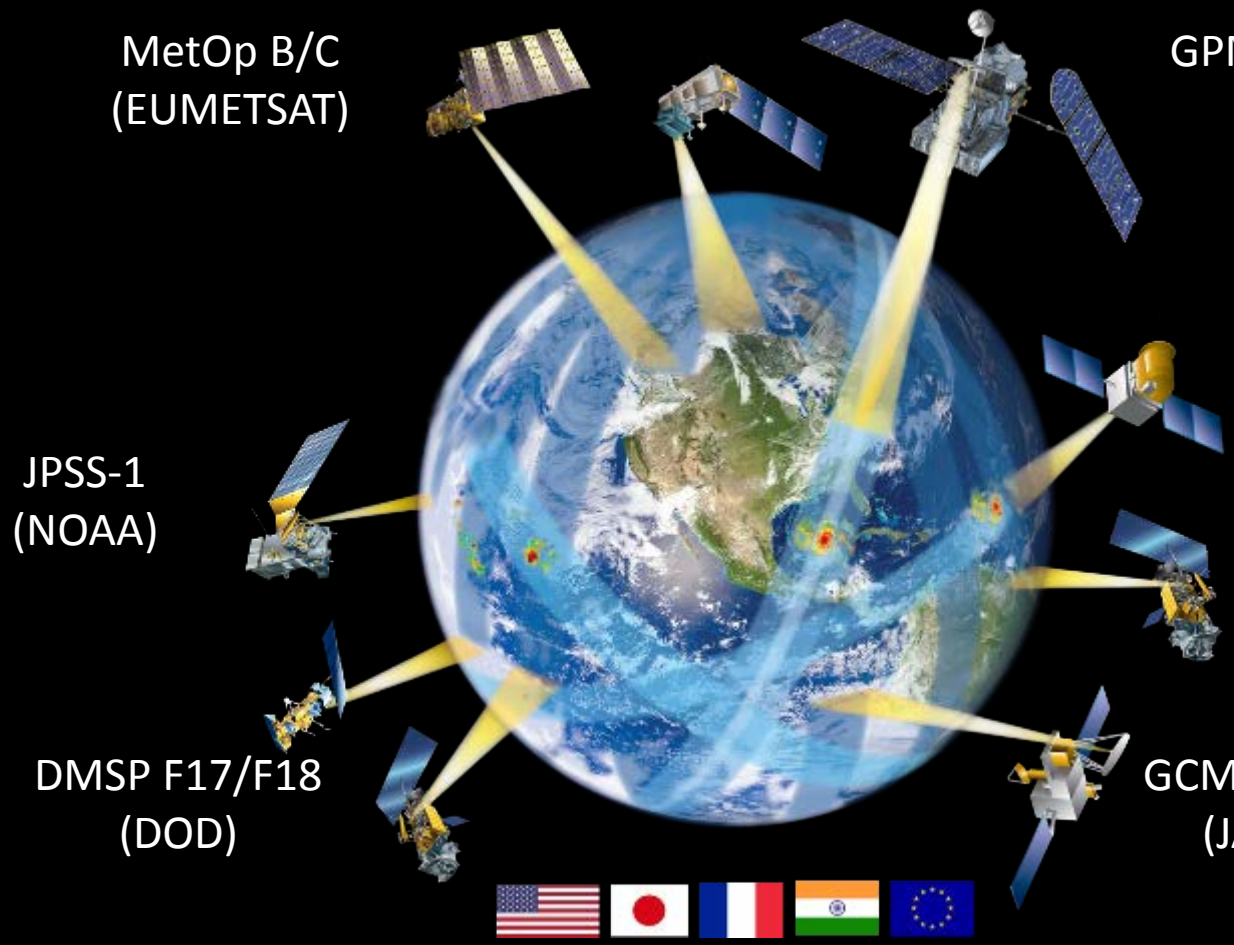
A BRIEF OVERVIEW BY DAVEN PATEL

05/30/18



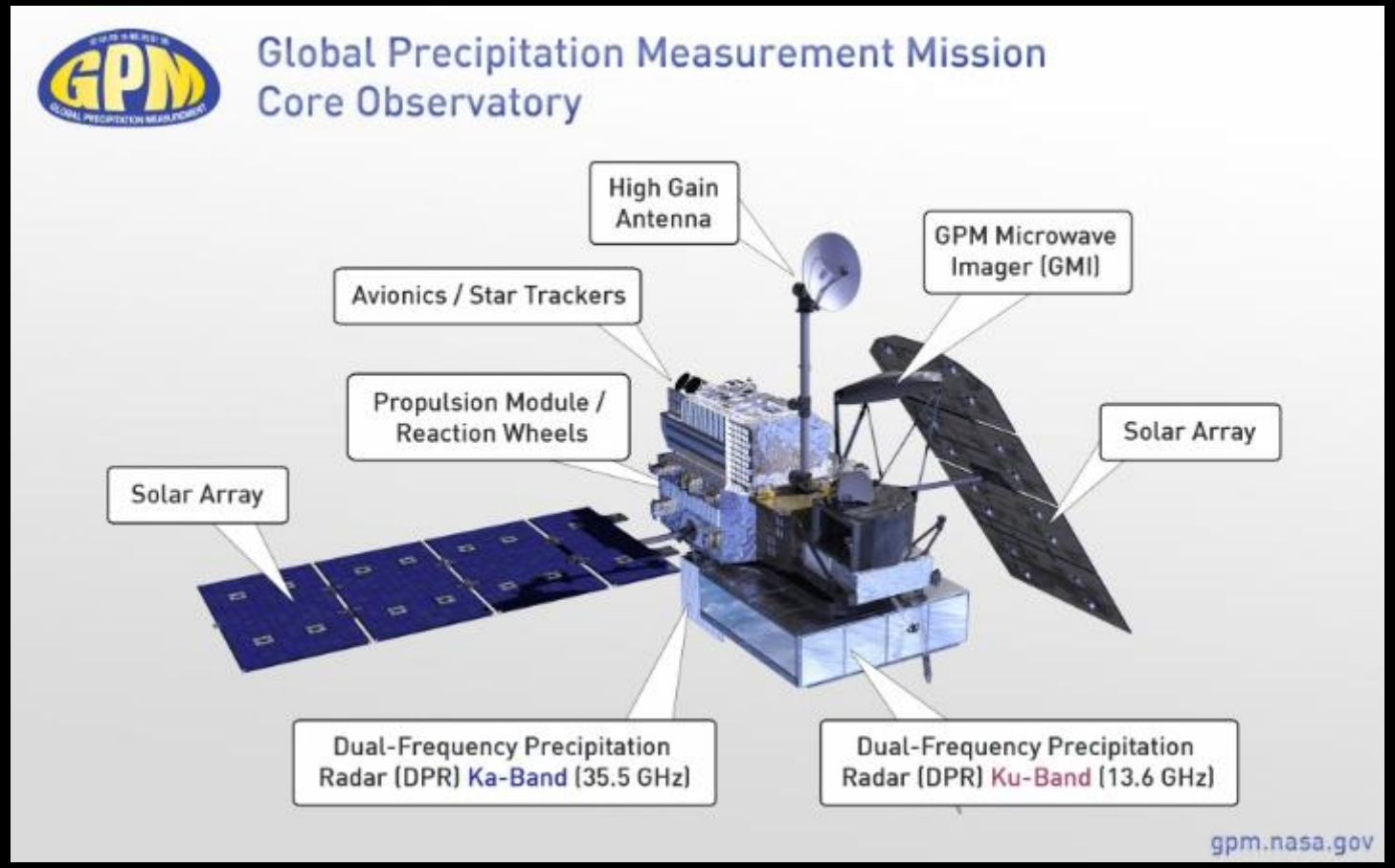
# GPM – GLOBAL PRECIPITATION MEASUREMENT

## CONSTELLATION OVERVIEW



# GPM – GLOBAL PRECIPITATION MEASUREMENT

## SPACECRAFT OVERVIEW



# GPM – GLOBAL PRECIPITATION MEASUREMENT

## MISSION OVERVIEW

- Advancing precipitation measurement capability from space
- Improving knowledge of precipitation systems, water cycle variability, and fresh water availability
- Improving climate modeling and prediction
- Improving weather predication and 4-D climate reanalysis
- Improving hydrometeorological modeling and prediction

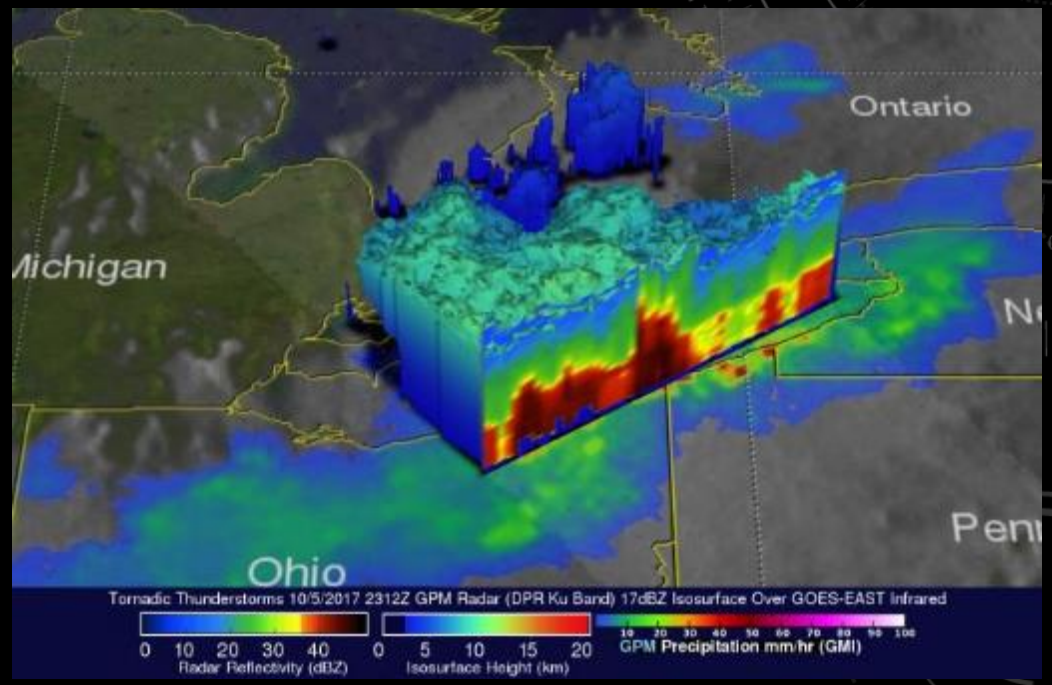
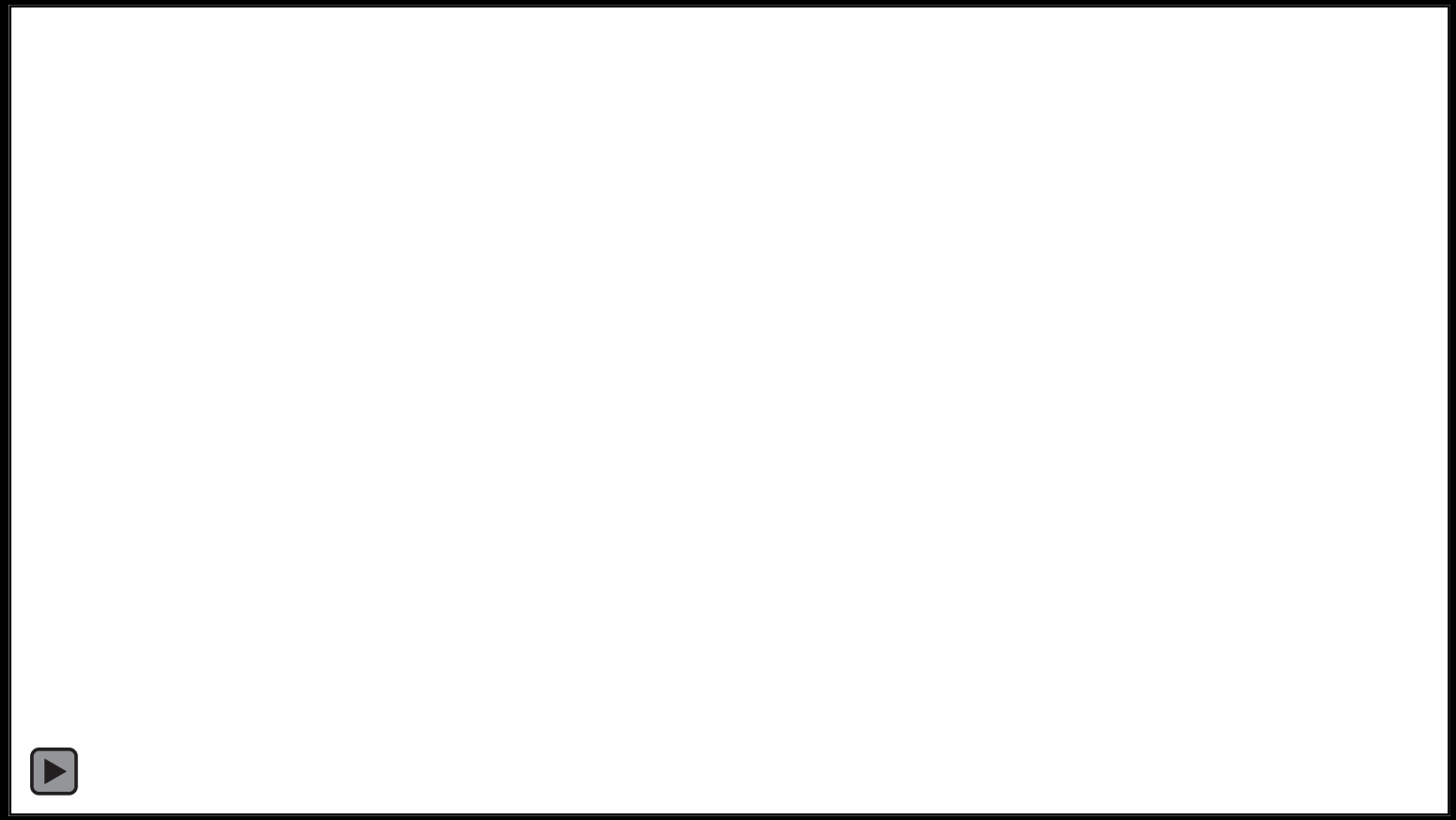



Image credit: NASA/JAXA, Hal Pierce

# GPM – GLOBAL PRECIPITATION MEASUREMENT

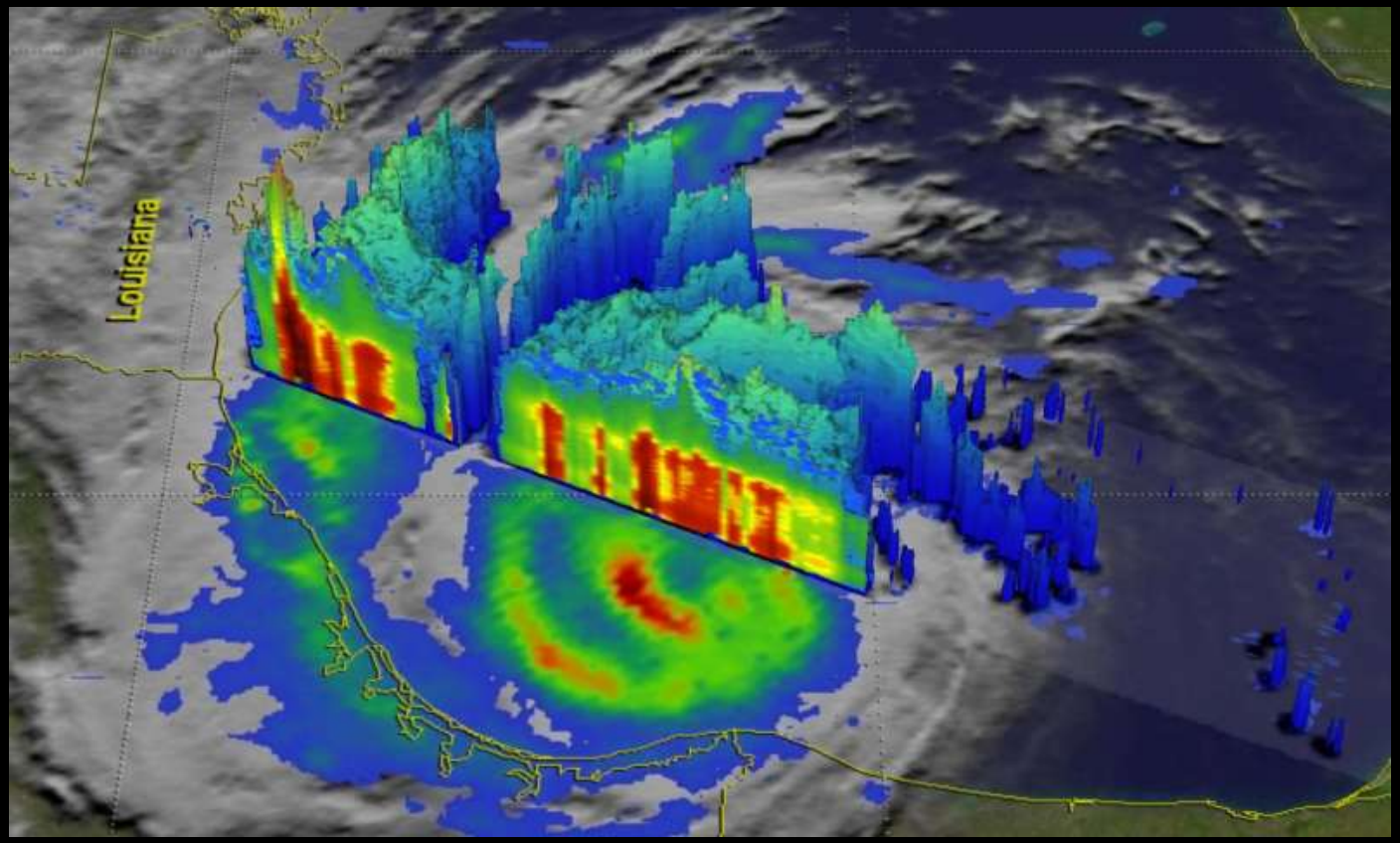
## INTEGRATED MULTI-SATELLITE RETRIEVALS FOR GPM (IMERG) SCIENCE PRODUCT



https://go.usa.gov/xNESIR

# GPM – GLOBAL PRECIPITATION MEASUREMENT

## PRECIPITATION PROCESSING SYSTEM (PPS) SCIENCE PRODUCT




Hurricane Harvey on Aug. 25, at 1150 UTC. Rain rate greater than 82 mm/hr.

Image Credit: NASA/JAXA, Hal Pierce

G
PERP
P
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# GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

## COMMAND AND DATA HANDLING OVERVIEW

- RAD750
  - 36 MB SRAM
  - 8 MB SRAM for SpaceWire
  - 4 MB EEPROM
  - SpaceWire router
  - MIL-STD-1553

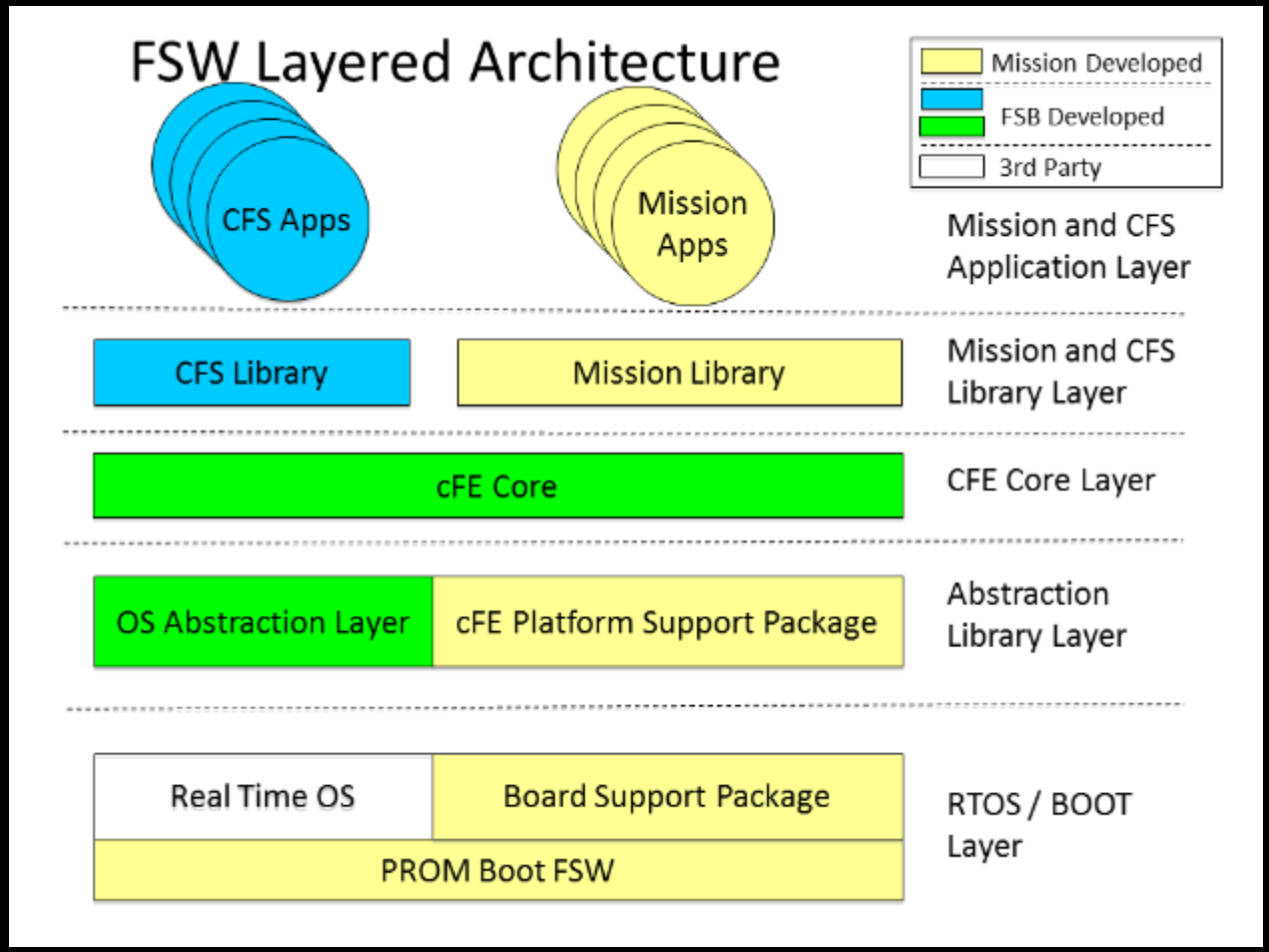
# GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

## COMMAND AND DATA HANDLING OVERVIEW

- EEPROM File System (EEFS)
  - Core Flight Executive (cFE) Startup Scripts
  - Uncompressed cFE Object Files
  - Default FSW Binary Table Files
  - Compressed Application Object Files
  - Libraries for all GPM FSW applications
- Local SRAM
  - All applications and tables

# GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

## COMMAND AND DATA HANDLING OVERVIEW



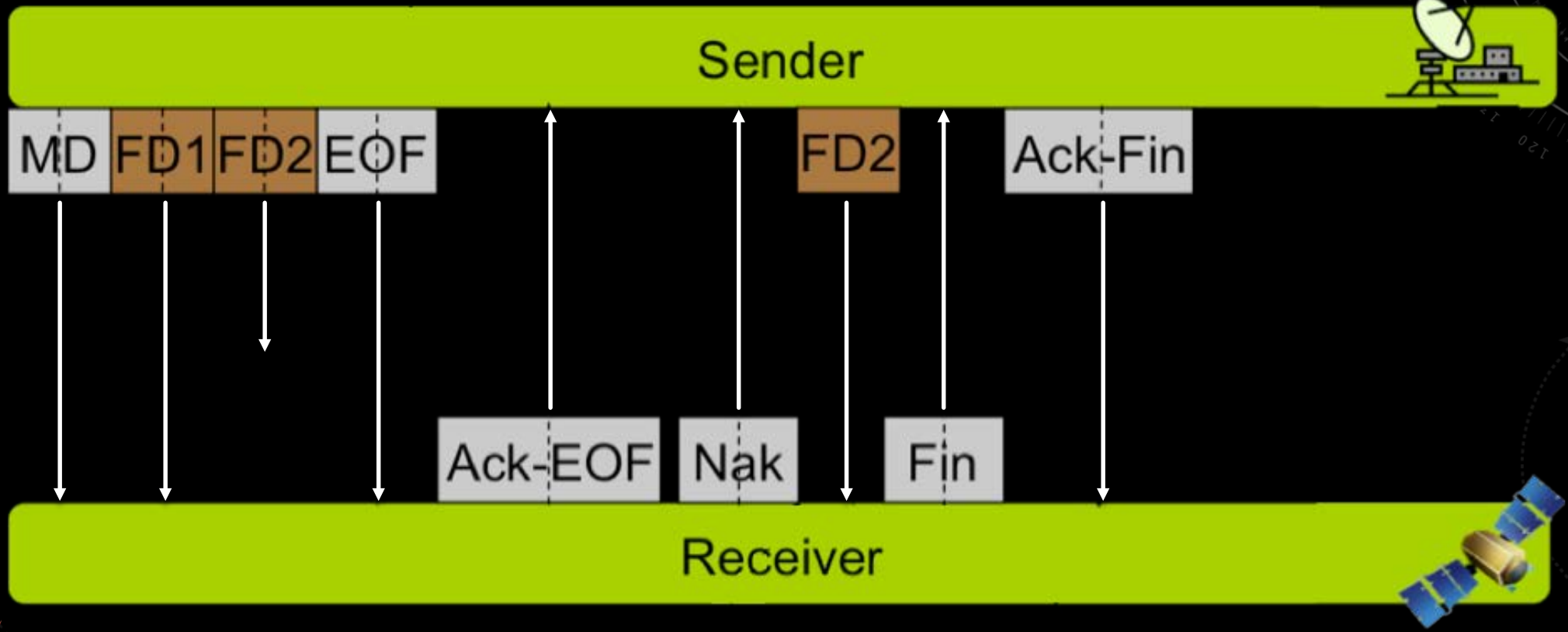
# GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

## SBC INITIALIZATION TYPES

| Reset Type | Reset Subtype | Cause |
|---|---|---|
| **Power On** | Power cycle | Power having been removed and restored |
| | Command | cFE processing a reset command |
| | HW debug | Debug mode connection |
| | Bank switch | Reset reverted to a cFE power on due to a bank switch |
| | Undefined | Unknown reset type |
| **Processor** | HW watchdog | Watchdog timer expiring |
| | Exception | Processor exception |
| | Command | cFE processing a reset command |

# GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

## CCSDS FILE DELIVERY PROTOCOL



# GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

## DIFFERENCE BETWEEN TRADITIONAL METHOD AND PERP

# 1 > Many

# GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

## FILE COMMANDING (FC) APPLICATION

The key to the PERP.

# GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

## FILE COMMANDING (FC) APPLICATION

- Interfaces with the cFE environment
- Processes ground-uplinked binary files
  - Reads command packets
  - Routes commands to the appropriate receiver application
- Processes five commands per second at max, one command per sixty seconds at min
- Allows for long commands otherwise not accepted by the ground system
- Unlimited queue with optional specified delay parameters

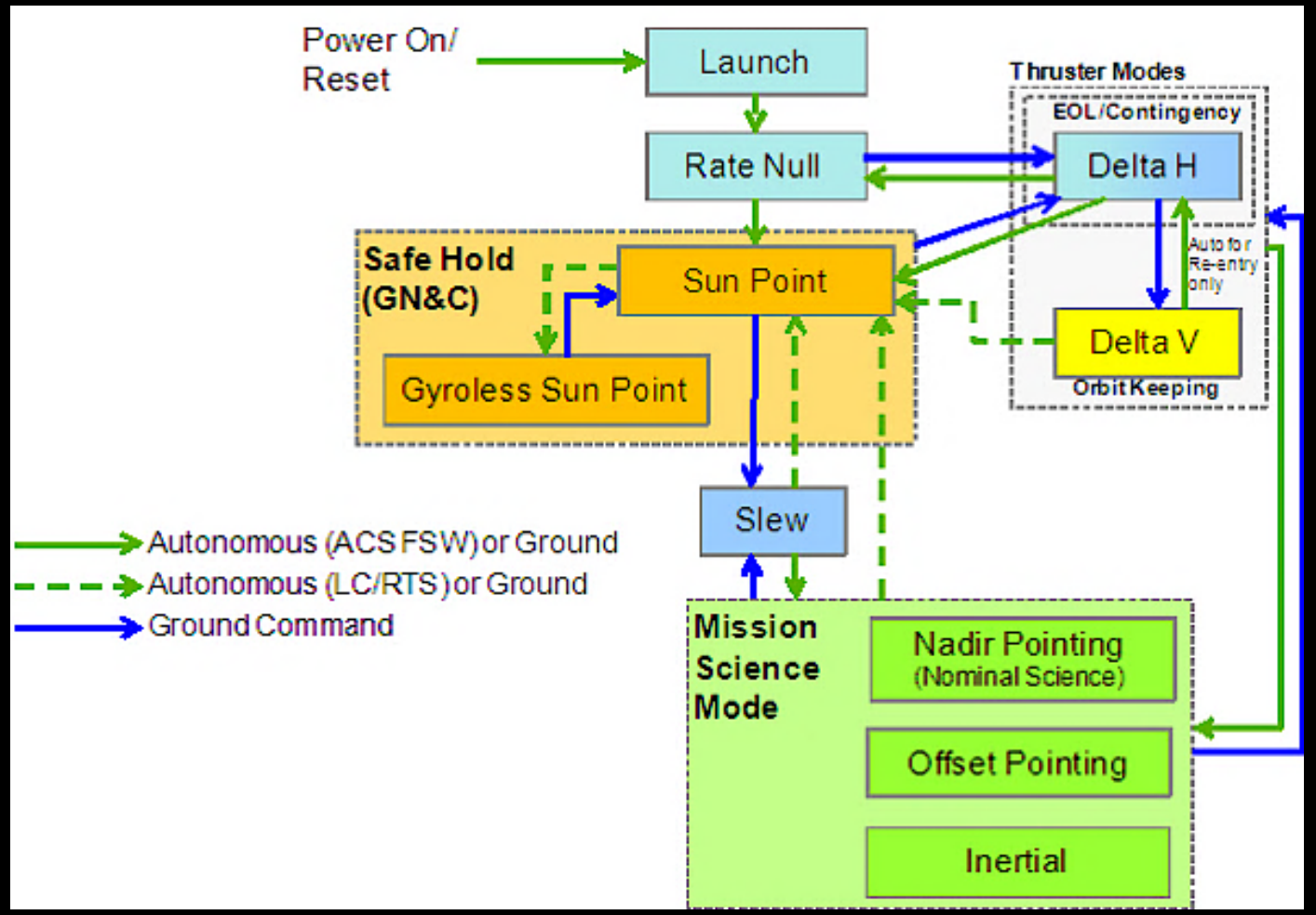
# GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

## RECOVERY PROCESS – LOAD BUILDING

1. Identify required loads and order in which to repopulate RAM.
2. Build procedure that performs the RAM reloading based on Step 1.
3. Run procedure from Step 2 on GPM Simulator.
4. Capture the commands sent to simulator and compile them.
5. Create FC file from the compiled commands.
6. Compress FC file.

# GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

## RECOVERY PROCESS – LOAD UPLINK



# GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

## RECOVERY PROCESS – WBS HOURLY COMPARISON

| Activity | Traditional Estimate | PERP Estimate |
|---|---|---|
| **Initial anomaly assessment** | 2 | 2 |
| **Scheduling of supports** | 8 | 2 |
| **Planning of RAM reload** | 3 | 1 |
| **CAM to reload RAM** | 3 | 1 |
| **Execution of RAM reload** | 40 | 2 |
| **FOT support required** | 720 | 72 |
| **Post-anomaly support** | 4 | 4 |
| **Total** | **780** | **84** |

# GPM MISSION'S BEST PRACTICES
# PERP DESIGN